

### **REMARKS**

The applicant respectfully requests reconsideration in view of the amendment and the following remarks. The applicant has amended the specification as suggested by the Examiner. The applicant has amended formula (II) in claim 1 as suggested by the Examiner. Support for the amendment for formula ((II) can be found in the original formula (II) and in formulas (III) to (VI). The applicant has amended claim 18 as suggested by the Examiner.

The Examiner has rejected claims 1-5 under 35 U.S.C. 112 first paragraph because the specification does not reasonably provide enablement for acyl substituents at other positions.

Claims 1-21, 26, 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lupo et al. (5,480,217) ("Lupo") with evidence supplied by Towle (4,898,983) ("Towle"). Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lupo and further in view of Pedersen et al. (Journal of Electroanalytical Chemistry, vol. 454, pp. 123-143, 1998). ("Pedersen").

### **35 U.S.C. 112, First Paragraph**

The Examiner has rejected claims 1-5 under 35 U.S.C. 112 first paragraph because the specification does not reasonably provide enablement for acyl substituents at other positions. In order to expedite prosecution, the applicant has amended claim 1 as suggested by the Examiner. For the above reasons, this rejection should be withdrawn.

### **35 U.S.C. 103(a) Rejections**

Claims 1-21, 26, 28-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lupo with evidence supplied by Towle. Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Lupo and further in view of Pedersen.

Lupo is cited in paragraph no. 5 of the published specification (US 2006/0006365). Lupo discloses the synthesis of different acetyl derivatives of 9,9'-spirobifluorene. Furthermore Lupo discloses the use of 9,9'-spirobifluorene derivatives for use in organic electroluminescent devices. However, Lupo does not disclose the synthesis of aroyl substituted derivatives of 9,9'-spirobifluorene. Furthermore, Lupo does not specifically disclose the use of the disclosed acetyl substituted spirobifluorene compounds. It has surprisingly been found that the use of the aroyl substituted spirobifluorene in an organic electroluminescent device gives much better results than the use of the corresponding acetyl substituted spirobifluorene. As a proof for this, the applicant has informed the undersigned that the following experimental results which are enclosed, establish the difference of the aroyl and the acetyl substituted derivative when used in an OLED. As established from these experimental results, the inventive compounds as claimed in claims 16 show both better efficiency and better lifetime compared to the corresponding acetyl compound. In contrast, the results obtained with the acetyl compound are comparable to Alq, which is a standard electron transport material according to the state of the art.

These results are unexpected results which are not obvious from the disclosure by Lupo. Even when considering that the general synthesis procedure for the synthesis of the inventive compounds is similar to that disclosed by Towle, a person skilled in the art could not have predicted that the inventive compounds have considerably better properties than the corresponding acetyl derivatives when used in an OLED. Therefore, the compounds as claimed in the applicant's claimed invention as well as the corresponding isolated enantiomers, the corresponding radical anions, the synthesis of these compounds and the use of these compounds in organic electronic devices are not obvious in view of the prior art. The applicant will submit this data in declaration form, if the Examiner requests. For the above reasons, these rejections should be withdrawn.

In view of the above amendment, applicant believes the pending application is in condition for allowance.

Applicant believes no fee is due with this response. However, if a fee is due, please charge our Deposit Account No. 03-2775, under Order No. 14113-00105-US from which the undersigned is authorized to draw.

Dated: December 18, 2007

Respectfully submitted,

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Enclosure: Experimental Results

## Experimental Results

### Device results: Production of organic electroluminescent devices

OLEDs are produced by a general process as described in WO 04/058911, which is adapted in individual cases to the particular circumstances (for example layer-thickness variation in order to achieve optimum efficiency).

The results of various OLEDs are presented in the following examples. The basic structure, the materials and layer thicknesses used, apart from the electron-transport layer, are identical for better comparability. OLEDs having the following structure are produced analogously to the above-mentioned general process:

Hole-injection layer (HIL)	60 nm PEDOT (spin-coated from water; purchased from H. C. Starck; poly(3,4-ethylenedioxy-2,5-thiophene)
Hole-transport layer (HTL)	20 nm NaphDATA (vapour-deposited; purchased from SynTec; 4,4',4''-tris(N-1-naphthyl-N-phenylamino)-triphenylamine
Hole-transport layer (HTL)	20 nm S-TAD (vapour-deposited; prepared in accordance with WO 99/12888; 2,2',7,7'-tetrakis(diphenylamino)spiro-9,9'-bifluorene)
Emission layer (EML)	30 nm spiro-DPVBi (prepared in accordance with WO 02/10093, 2,2',7,7'-tetrakis(2,2'-diphenylvinyl)spiro-9,9'-bifluorene) doped with 1% of S-TAD (2,2',7,7'-tetrakis(diphenylamino)spiro-9,9'-bifluorene)
Electron conductor (ETL)	20 nm – 40 nm (precise structure see examples in Table 1) (vapour-deposited: AlQ <sub>3</sub> purchased from SynTec; tris(quinolinato)aluminium(III) or electron-transport materials <b>E1</b> or <b>E2</b> )
Ba/Al (cathode)	3 nm Ba, 150 nm Al on top.

For the characterization, the electroluminescence spectra, the efficiency (measured in cd/A), the power efficiency (measured in lm/W) as a function of the brightness, calculated from current-voltage-brightness characteristic lines (IUL characteristic lines), and the lifetime are

determined. The lifetime is defined as the time after which the initial brightness of the OLED has dropped to half at a constant current density of  $10 \text{ mA/cm}^2$ . For the electron-transport layer, the layer thickness was optimized separately for each material. For better comparison, however, the greater AlQ<sub>3</sub> layer thicknesses, which are directly comparable with the layer thicknesses of **E1** and **E2**, are also shown.

Table 1 shows the results of some examples, with the composition of the ETL including the layer thicknesses also being shown in each case. As electron-transport material, the ETLs comprise compounds **E1** to **E4**. The comparative examples used are OLEDs which comprise AlQ<sub>3</sub> as electron conductor in accordance with the prior art.

For better clarity, the structural formulae of the substances used are shown below:

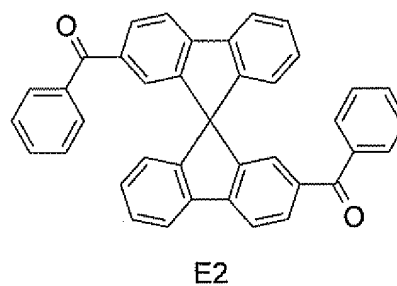
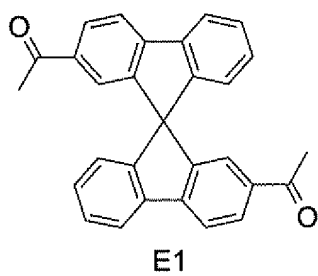
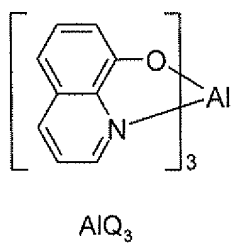
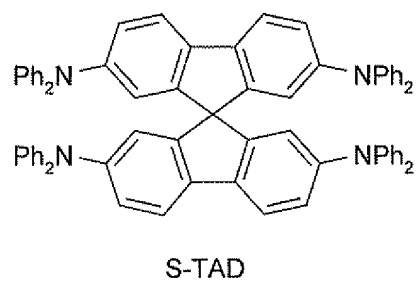
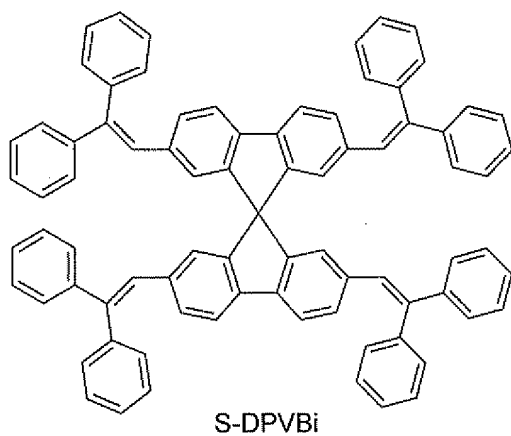


Table 1:

Example	ETL	Max. efficiency (cd/A)	Power efficiency @ 100 cd/m <sup>2</sup> (lm/W)	CIE (x, y)	Lifetime (h) at 10 mA/cm <sup>2</sup>
<b>Example 1</b> (comparison)	AlQ <sub>3</sub> (20 nm)	4.2	1.8	0.17 / 0.23	700
<b>Example 2</b> (comparison)	AlQ <sub>3</sub> (40 nm)	3.5	1.7	0.17 / 0.30	650
<b>Example 3</b>	E1 (40 nm)	4.5	2.3	0.17 / 0.23	500
<b>Example 4</b>	E2 (40 nm)	4.8	2.6	0.17 / 0.22	1050